WELL REAMER

Field of Invention

The invention relates to drilling technique, in particular, to devices for borehole reaming within a specified interval.

Description of Related Art

There is known a well reamer, comprising a housing with inclined slots and a piston placed in it which is spring-loaded through a rod, legs with journals fixed in inclined slots of the housing, on which journals cantilevered rolling cutters are provided (Inventor's certificate of the USSR No 582373, class E21B 7/28, 1971).

A shortcoming of the known device is the lack of reliable centering in a well, since no more than two operating elements may be provided in the housing without detriment to its strength. This results in vibration and whipping during the process of well reaming. In so doing, the surface of the reamed well section becomes irregular, which does not provide for qualitative installation of profile liner in isolation of trouble zones during wells drilling. Rate of borehole reaming is also low.

Additionally, in the known reamer, the rolling cutters are fixed on cantilevered legs without fixing the free ends of journals, which lowers the strength of operating elements and leads to breakage at heavy mechanical loads.

There is another known reamer, which comprises a housing with inclined slots and a central straight-through channel in which a rod is placed and spring-loaded towards the lower end of the housing, legs with journals fixed in inclined slots of the body, on which journals rolling cutters are provided and supported. Free ends of legs' journals are fastened, and interact with the rod through pushers (Patent of the Russian Federation No 2172385 class E21B 7/28, 2001).

Shortcomings of this device include low serviceability and reliability due to presence in its design of a ring piston, rigidly connected with the rod, and pushers of supports in the form of two-member links, which cannot withstand heavy power loads. Additionally, the design of the known reamer does not allow to exercise control over settings of the operating elements into

working position.

Summary of the Invention

An object of the invention is to increase of serviceability and reliability of a reamer.

The object is achieved by a well reamer, comprising a housing with inclined slots and a central straight-through channel, in which a rod is placed and spring-loaded towards a lower end of the housing. Legs having journals are provided in the inclined slots of the housing, and rolling cutters are provided and supported by the journals. The free ends of legs' journals are secured, and interact with the rod through pushers. According to the invention, the pushers of supports are made in the form of cylindrical pistons, placed in inclined bores of the housing and tightened relative to its straight-through channel and annulus environment, of which some ends are connected to the supports, and the others ends are connected to the rod with the possibility of radial movements with respect to the walls of the housing. The central straight-through channel of the housing communicates with annulus environment through first and second holes in the walls of the housing and the rod. Those holes are covered while extending the legs and the cutters to an operating position.

Brief description of the drawings

Fig. 1 is a longitudinal section of a reamer in accordance with the present invention in the transport position;

Fig. 2 shows the reamer of Fig. 1 in the operating position; and

Fig. 3 is a sectional view taken on III-III in Fig. 1.

Detailed description of the preferred embodiment

A well reamer (Fig. 1) comprises a housing 1 with a central straight-through channel 2, in which rod 3 is placed and spring-loaded by a spring 4 towards the lower end of the housing 1. The spring 4 is positioned in a chamber 5, which is formed by an inner wall of the housing 1 and an outer wall of the rod 3. The chamber 5 communicates through first holes 6 in the wall of the housing 1 with the environment and through second holes 7 in the wall of the rod 3 - with the

central straight-through channel 2 of the housing 1. The chamber 5 is isolated from the straight-through channel 2 by seals 8, and the second holes 7 of the rod 3 may be covered by a thrust bushing 9 after the rod 3 has come to the upper most position.

The housing 1 has outer inclined first slots 10 (Fig. 1, 3) of "dovetail" type, in which legs 11 are provided with journals 12. On the journals 12, cutters 13 with hard-alloy teeth 14 are provided for rotation about the journals 12. The legs 11, acting as calibrators, are provided with similar teeth. Free ends 15 of the journals 12 are supported by supports 16, which are also installed in the inclined first slots 10 of the housing 1 and are rigidly connected to cylindrical pistons 17, arranged in inclined bores 18 of the housing 1. The pistons have free ends 19 and sliders 20 which may be secured in third holes (openings) 21 of the rod 3 with the possibility of radial movements. The bores 18 through a longitudinal second slot 22 of the housing 1 communicate with the straight-through channel 2 of the housing 1 and are isolated from the environment by seals 23.

On ends of the housing 1 some threads are provided: a thread 24 for connection with drill string 25 (Fig. 2) through a reducer 26, and a thread 27 for attaching of a drilling bit having bean washout ports (not shown).

The well reamer operates in the following way.

A drilling bit (not shown) is screwed in the thread 27 of the housing 1, and the reducer 26 is screwed on the thread 24, the reamer is connected to the drill string 25 and inserted into a well 28 (Fig. 2).

At the prescribed well depth one starts rotation of the drill string 25 and simultaneously supply into it a washing fluid, which flows into the central straight-through channel 2 of the housing 1 and further - into washout ports of the bit, in which differential pressure is created. As the differential pressure above the bit increases, pistons 17 connected with the rod 3 by the sliders 20 overcomes the power of spring 3 and moves the supports 16, the cutters 13, and the legs 11 along the inclined first slots 10 into the operating position, up to the stop at an end face 29 of the reducer 26. At that position, the fluid from the chamber 5 is displaced into annulus environment of the well 28 through the first holes 6 of the housing 1, while the second holes 7 in the rod 3 are covered by the thrust bushing 9, which results in an abrupt pressure increase in the

reamer and serves as a signal that operating elements (the legs 11 and the cutters 13) of the reamer have been extended into the operating position. Further, by moving the reamer downward, the well is reamed within a specified interval.

Upon completion of the borehole reaming; the fluid injection into the drill string 25 is ceased. In so doing the spring 4, being extended, returns the rod 3 and the pistons 17 connected therewith as well as the supports 16 and the legs 11 with the cutters 13 to a transport position.

In moving the operating elements between the working position and the transport position the sliders 20, which are connected to the pistons 17 moving through second slots 22 in the housing 1, make radial movement in the third holes (openings) 21 of the rod 3 - moving into and out of the third holes (openings) 21.

Such a design of the reamer provides an improved mechanism for extending the operating elements extension into the operating position and control over the extension, which increases serviceability and reliability of the reamer.